

The Orthopositronium Problem and e - μ - τ -Universality

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February 1, 2008

Abstract

The quantitative description of the orthopositronium anomalies (“isotope anomaly” in a gaseous neon for the “resonance conditions” and “ λ_T -anomaly” in non-resonance conditions) is possible on the basis of a hypothesis about restoration of spontaneously broken *complete relativity* (A.F.Andreev, 1982) of the limited space-time “volume” (“defect” of the space-time) in a final state of β^+ -decay ($\Delta J^\pi = 1^+$) of nucleus such as ^{22}Na , ^{68}Ga , etc. This addition of the Standard Model in a final state of the topological quantum transition (non-steady-state, a generalized “displacement current”) supposes the description on the common basis timelike fundamental particles (locality) and spacelike fundamental structure (*non-locality without causal paradoxes*). One of achievements of expansion of Standard Model can be a substantiation of topological connection e - μ - τ -Universality with discrete structure (quantization) “defect” of the space-time.

Consideration by analogy with orthopositronium [$o - Ps \equiv {}^3(e_\beta^+ e^-)_1$] of the atoms ${}^3(\mu^+ \mu^-)_1$ and ${}^3(\tau^+ \tau^-)_1$ finds out basic difference of the top generations of leptons: impossibility of realization for ${}^3(\mu^+ \mu^-)_1$ - and ${}^3(\tau^+ \tau^-)_1$ -atoms, even in some Gedanken experiment, a conditions similar to the “resonance conditions” at supervision of the “isotopic anomaly” in samples of a gaseous neon of various isotope abundance [1,2]. If to treat it as spontaneous breaking of the horizontal symmetry of the leptons generations, then their participation in formation of the fundamental space-like structure within the framework of “*additional $G\hbar/c$ -physics*” would be natural consequence of restoration of the mentioned symmetry in a final state of β^+ -decay for a time $\tau_\mu \sim R_\mu/c \sim 10^{-6}$ s [3-5].

Let’s present discrete, space-like and two-sign (\pm , on mass and all charges, including baryon charge) structure as a tachyonic medium [6], formed in a final state of the β^+ -decay of nucleus ^{22}Na , etc ($\Delta J^\pi = 1^+$). The linear sizes of the fundamental space-like structure presented in [4] – “virtual fundamental length” $\Delta \simeq 5.5 \cdot 10^{-2}$ cm and the size of the “long-range atom” $2R_\mu \simeq 1.1 \cdot 10^5$ cm –

we shall compare with a the characteristic length of the tachyonic instability [6]

$$L > C / \Gamma, \quad (1)$$

where C – the characteristic rate agreed in this specific case with velocity of light c , and Γ is an inverse time of development of instability (s^{-1}).

For revealing the physical content of the assumed comparison is important presented in [6] isomorphism of the equations of the tachyonic field

$$(\omega^2 + C^2 \cdot \nabla^2 + \Gamma^2) \cdot \Psi = 0 \quad (\hbar = 1)$$

and of the Schrödinger equation for the stationary state of the “particle” with mass m ($m = 1/2$)

$$[\nabla^2 + E - V(x)] \cdot \Psi = 0,$$

i.e. a conformity takes place

$$\omega^2/C^2 \iff E, \quad \Gamma^2/C^2 \iff -V(x),$$

if to consider value Γ depending from the spatial coordinate x .

It follows that tachyonic instability ($\omega^2 < 0$, $\omega = i\Gamma$, $\Psi \sim (\exp|\Omega|t)$) is appropriate to the bound state $-\Gamma^2/C^2$ in an attraction field, and a negative energy of a compensating field (the “*mirror Universe*” [3-5]) can be presented as the binding energy $E_b = |M_{Pl}| \cdot c^2$ of the vacuumlike substance component with mass $M_{Pl} > 0$ of the whole fundamental space-like structure. We receive the increment increase of the tachionic field [6]

$$\Psi \sim \exp(\Omega t), \quad \Omega = C \cdot (-E_b)^{1/2},$$

and Ω in a considered context accepts value

$$\Omega = \frac{c \cdot [2M_{Pl}(-M_{Pl} \cdot c^2)]^{1/2}}{\hbar} \sim it_{Pl}^{-1} \sim i \cdot 10^{43} s^{-1}. \quad (2)$$

All “sites” of the crossing of “spaces” X (in the observable world) and X' (an inverse “space” – the “mirror Universe”) “stick together” in “point” in the space $3+N'$ -dimensions: $\{X\} = \{X'\} = 0$. In the space of the observer it allocates the “central” site of “lattice” of the fundamental macroscopical space-like structure with which in a final state of the β^+ -decay ^{22}Na (e^+ , ν) $^{22*}Ne$ the daughter nucleus $^{22*}Ne$ has been linked. The four-dimensional fundamental space-like structure of the size $2R_\mu$ in the $3 + N'$ -dim space is captured by Planckian length l_{Pl} . Process of the tachyonic instability by the conserve of the angular momentum is limited. Specifically, a “self-unwinding” of the fundamental space-like structure in the β^+ -decay final state by a difference of the angular moments of the final and initial states (^{22}Na , ^{68}Ga , etc) is limited

$$\Delta J = \hbar > I_\mu \cdot c/R_\mu, \quad (3)$$

as velocity of the fundamental space-like structure on its “surface” cannot exceed the velocity of light. In (3) $I_\mu \sim m_\mu \cdot R_\mu^2$ is the moment inertia of a

spherical humming-top, $m_\mu \sim \hbar/R_\mu c$ is its mass. Hence, practically instant "self-unwinding" of the fundamental space-like structure ($|\Omega| \sim 10^{43} s^{-1}$) periodically undergoes a failure and again renews with a casual directions of the angular momentum. This result give proof to the postulate about the casual rotation of the "mirror Universe" with a velocity $V \sim -c$ in respect to the ground-based laboratory (to an *observer*) [7].

The observer perceives additional discrete structure of the "mirror Universe" as discrete scalar *C-field* [8] with a negative sign on all physical "charges" (including mass of "holes" – "proton" and "electron" in the structure of "lattices") [4]. *C-field* compensates of the limited "volume" of the space-time ($\sim 1 km^3$, during $\sim 2 \cdot 10^{-6} s$) – the *vacuumlike state of matter* (VSM) [9] (the "*long-range atom*" with *Planckian mass* also perceived by the observer as microstructure of the VSM and 1-dim discrete space ($N' = 1$)).

As a whole the final state of the β^+ -decay ($\Delta J^\pi = 1^+$) represents 5-dim ($3 + 1', t$) with discrete structure of the spatial dimensions in the limited "volume" of the space-time.

Inequalities (comp. with (1))

$$\Delta > \frac{c}{\Gamma_\tau} cm \quad \text{and} \quad 2R_\mu > \frac{c}{\Gamma_\mu} cm \quad (4)$$

where Γ_τ ($\sim 3.3 \cdot 10^{12} s^{-1}$) and Γ_μ ($\sim 4.5 \cdot 10^5 s^{-1}$) , accordingly, are the decay width of the τ - and μ -leptons, show that in structure of the value $\Gamma(x)$ is available the contribution of a topological component of the increase of the tachyonic field – width of decay of leptons Γ_τ, Γ_μ (Γ_τ / μ), defining the rate development of an instability.

The topological component limits the rate of increase of the instability as a time of the consecutive transitions is defined by sum of characteristic times

$$\frac{1}{\Gamma(x \sim \Delta / x \sim R_\mu)} = \frac{1}{\Gamma_{\tau / \mu}} + \frac{1}{|\Omega|}$$

and

$$\Gamma(x \sim \Delta / x \sim R_\mu) = \frac{\Gamma_{\tau / \mu} \cdot |\Omega|}{\Gamma_{\tau / \mu} + |\Omega|} \cong \Gamma_{\tau / \mu} \quad (|\Omega| \gg \Gamma_{\tau / \mu}). \quad (5)$$

The width of the leptons decay is defined by the the weak interaction constant. Thus, unification of the all interactions on the basis of antipodic symmetry [10] in the "additional $G\hbar/c$ -physics" (*superantipodic symmetry* [3]) on the basis of their own coupling constants take place, instead of a uniform constant as it is supposed in the standard "Theory of Everything" at ultrahigh energy. It means, that the impossibility to fix a *coupling constant* for the *Goldstone field* in the theory with spontaneously broken complete relativity [11] is not lack of the theory.

In the offered concept "additional $G\hbar/c$ -physics" the top generations of the leptons adjust the bifurcation attitude mutually supplementing aspects of

strong interaction: one – with participation of color (quantum cromodynamics/aromadynamics) [12], and another – a non-stationary long-range for a baryon (and lepton) charge [3-5].

Let's note, that the estimation of the mass presented here fundamental space-like structures $m_\mu \sim \hbar/R_\mu c \sim 3 \cdot 10^{-10} eV$ is kept at extremely wide limits admissible by Standard Model for mass invisible acsion, is closer to its lower limit $\sim 10^{-12} eV$. If the “long-range atom” at the moment of a birth in final state of β^+ -decay or as result of the its subsequent diffusion is brought into gravitational field with the critical value of acceleration of free falling

$$\gamma_{cr} = \frac{\hbar \cdot c}{m_p \cdot R_\mu^2} \geq 0.01 \text{ cm/s}^2,$$

there is its “splitting” on plus\minus Planck masses (non-steady-state, the *generalized displacement current*), i.e. in one-stage (from “*nothing*”!) “elementary” macroscopical “domain” of a dark matter with mass $2|M_{Pl}|$ is born [13].

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